MICROCOPY RESOLUTION TEST CHART

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19 ABSTRACT (Continue on reverse if necessary and identify by block number)

/ The lack of an inexpensive, commercial Langmuir-Blodgett film-deposition trough prompted us to build our own for the deposition of fatty-acid salts and tailor-made photochemically active agents upon a number of substrates. The films are characterized by their pressure-area isotherms, which are recorded by monitoring the film's surface pressure while compressing the surface area. Dipping requires slow immersion and removal of a substrate while continuously maintaining a preset surface pressure. Both of these tasks can be accomplished under microcomputer control.

The software, run on an Apple II, is written in FORTH, allowing full, interactive control of dipping. The Apple controls a dc stepping motor, which compresses the film surface, while simultaneously monitoring a Cahn microbalance which reports surface pressure on a Wilhelmy plate. Pressure-area isotherms, standardized in molecular units of square angstroms, are displayed on the Apple screen and can also be stored or plotted. The deposition

- see reverse side -

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) substrate is mounted on a dipping arm driven by an ac motor. When dipping a sample, the Apple maintains the optimal surface pressure (as read from the isotherm), 0-100($\pm$0.1) dyne cm^{-1}, throughout the deposition process, allowing multilayer structures to be built automatically. The dipping rate is variable, allowing for slow deposition of initial layers and proceeding to faster deposition for subsequent layers. Finally, the Apple monitors the change in film area during dipping, to ensure full film uptake.

OFFICE OF NAVAL RESEARCH

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Technical Report No. UWIS/DC/TR-86/1

Microcomputer-Controlled Langmuir-Blodgett Dipping Trough

by

Hal Van Ryswyk, Joann M. Eisenhart, Nils Blom, and Arthur
B. Ellis[*]

Prepared for Publication in

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Department of Chemistry
Madison, Wisconsin 53706

September 10, 1986

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The trough used for the remaining film studies was milled from a solid piece of teflon, approximately 2 x 12 x 12 inches. The final dimensions of the trough are given in Figure 4.13, as is a schematic of the trough design. The trough was encased in aluminum to prevent distortion of the teflon. Sweeping arms and a compression arm were cut from excess teflon, and encased in aluminum metal to prevent warping. Figure 4.14 shows an expanded view of the final trough setup, including structure dimensions. The compression arm was connected to a stepping motor (Hurst Model #AS-30) to allow forward and reverse motion. A schematic of the dipping

Figure 4.13.   Schematic of Langmuir trough.   Inner

trough dimensions are 7" x 10 1/2" x 1/2 ".

Dipping well is 3/4" from one end and

2 1/4" from either side; its dimensions

are 2 1/2" x 1" and it extends 1/2" below

the trough floor.   The entire trough is

encased in 1/4" thick aluminum plate
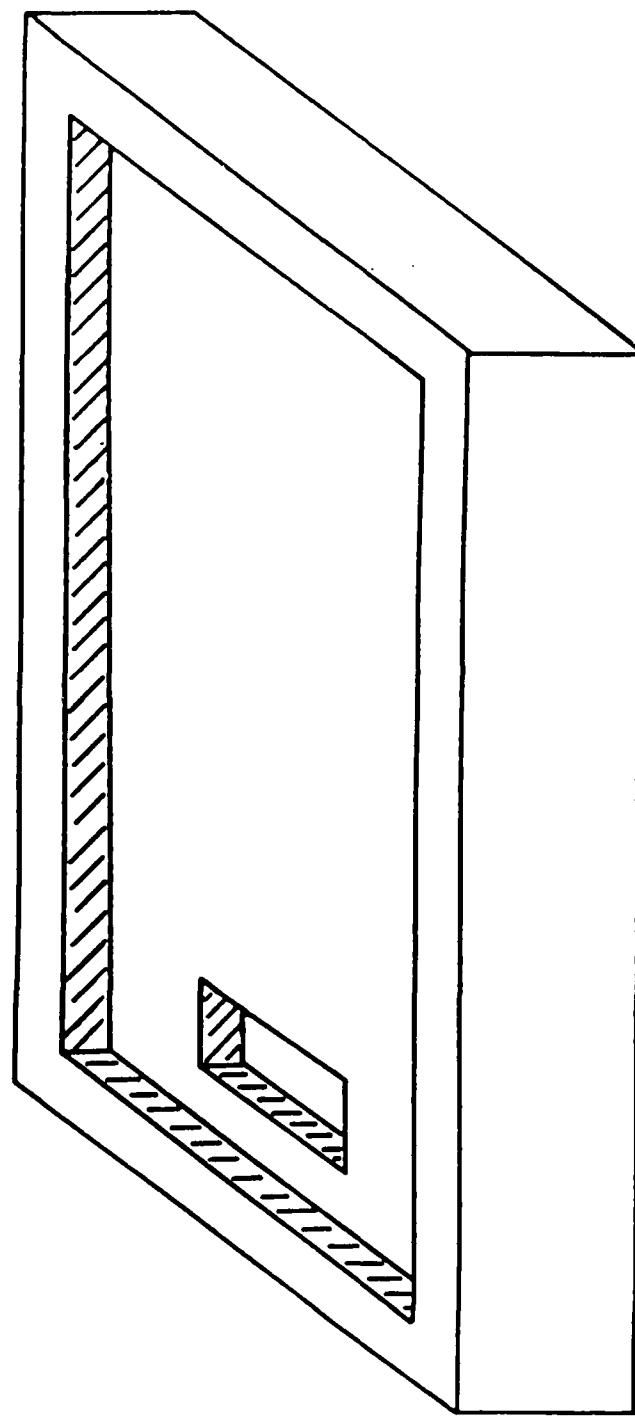
metal.

Figure 4.14.   Schematic of trough setup. Floors are
made of 1/2" thick aluminum plate metal.
The bottom floor has dimensions of 12" x
16"; other floors are shown to scale,
relative to the bottom floor, in the
drawing. Support posts, shown as dashed
lines in the drawing, are constructed from
3/4" diameter aluminum rods. The second
floor is 3 1/2" above the bottom floor;
the third floor is 15 1/2" above the
bott loor. Components of the setup,
labelled in the diagram, are: (a) Bottom
(motor) floor; (b) Motor block, consisting
of stepping motor (not shown) and guiding
mechanism for compression arm. The turn
screw has 20 turns/inch; (c) Second
(trough) floor; (d) Aluminum encased
trough; (e) Compression arm which mates to
posts on guiding mechanism; (f) Third
(balance) floor; (g) Cahn Model 27
automatic electrobalance with external
control unit (not shown). A hole is
drilled in the third floor metal to allow
suspension of the Wilhelmy plate below the
balance. The entire setup is encased in a
plexiglass case to prevent air drafts and
contamination from dust.
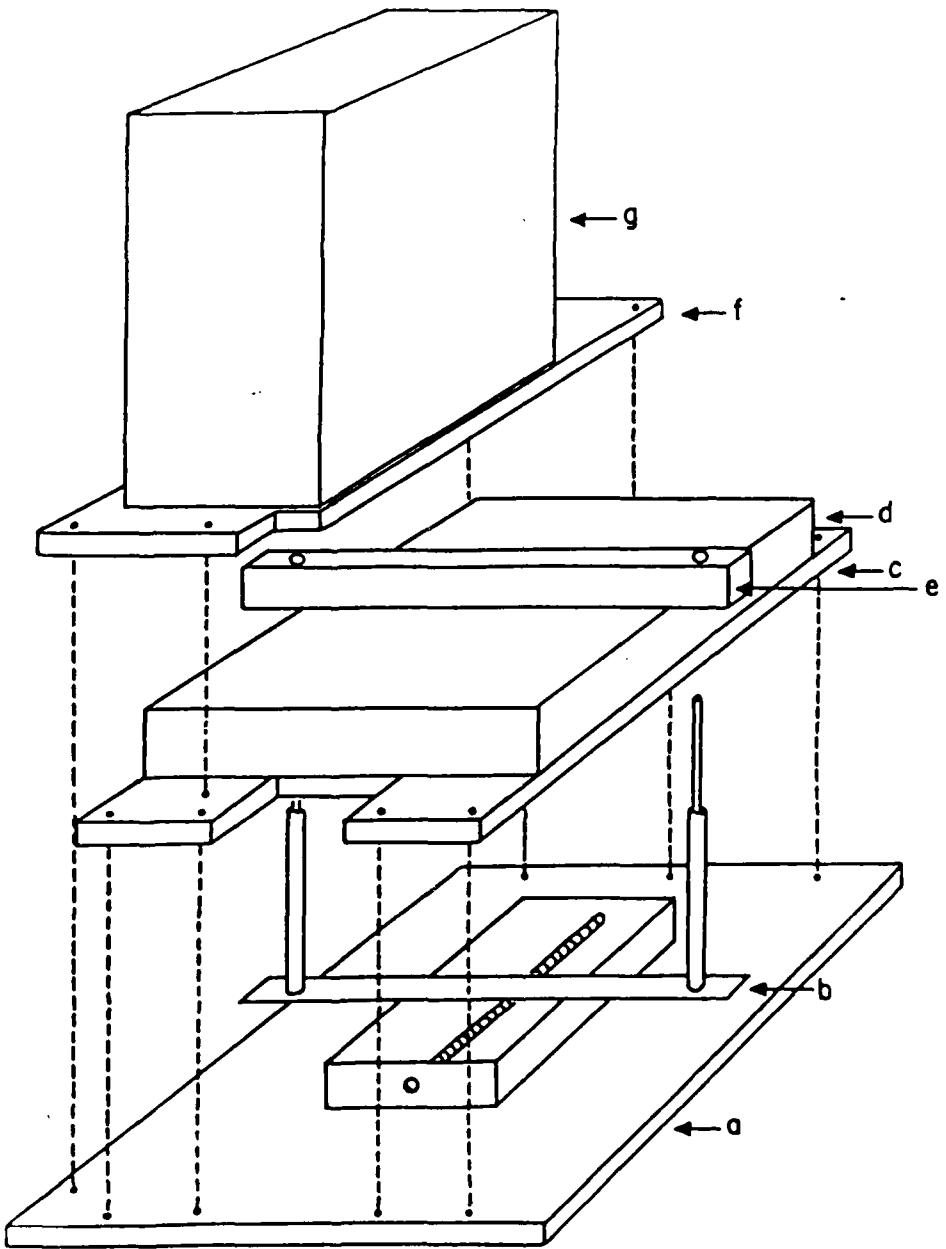
arm is shown in Figure 4.15. This arm was connected to a
continuous, reversible motor (Japanese Servo Co., Model
RH2T6P4 connected to a Japanese Servo Co. gearbox
Model #6H60) to allow immersion and removal of
substrates from the water surface.

Surface pressures were measured using a platinum
Wilhelmy plate (obtained from Cahn Instruments); plate
dimensions are 2 cm x 1 cm x ~0.005 cm. The Wilhelmy
plate was flamed clean before each use and was suspended
from a Cahn Model 27 automatic electrobalance, which
maintained the plate at a constant immersion depth
throughout the experiments. The electrobalance and both
motors were interfaced to an Apple IIe computer. In
this manner, computer control was available for every
step in the deposition process and for obtaining π-A
curves. The computer program for running the trough was
written in Forth, and is reproduced in Appendix I.
Appendix 2 shows a schematic of the interface between
the motors, the electrobalance, and the computer.

Figure 4.15. Schematic of dipping arm. The entire unit
stands 14" tall. Square plates, shown in
the drawing, are constructed from 1/2"
thick aluminum plate metal and are 2 3/8"
along each side. Posts, shown as lines in
the drawing, are constructed from 1/4"
diameter aluminum rods. Components of the
dipping arm, labelled in the drawing, are:
(a) Continuous, reversible motor; (b)
Gearbox; (c) Turn screw (20 turns/inch);
(d) Limit switches, attached to aluminum
blocks mounted on aluminum rod. The limit
switches can be positioned through use of
set screws in the aluminum block;
(e) Microscope slide holder.

d

e

c

b

a

FRONT OF BOX

pilot lamp

ON
OFF

DIP
CONTROL

FAST

SLOW

B

A
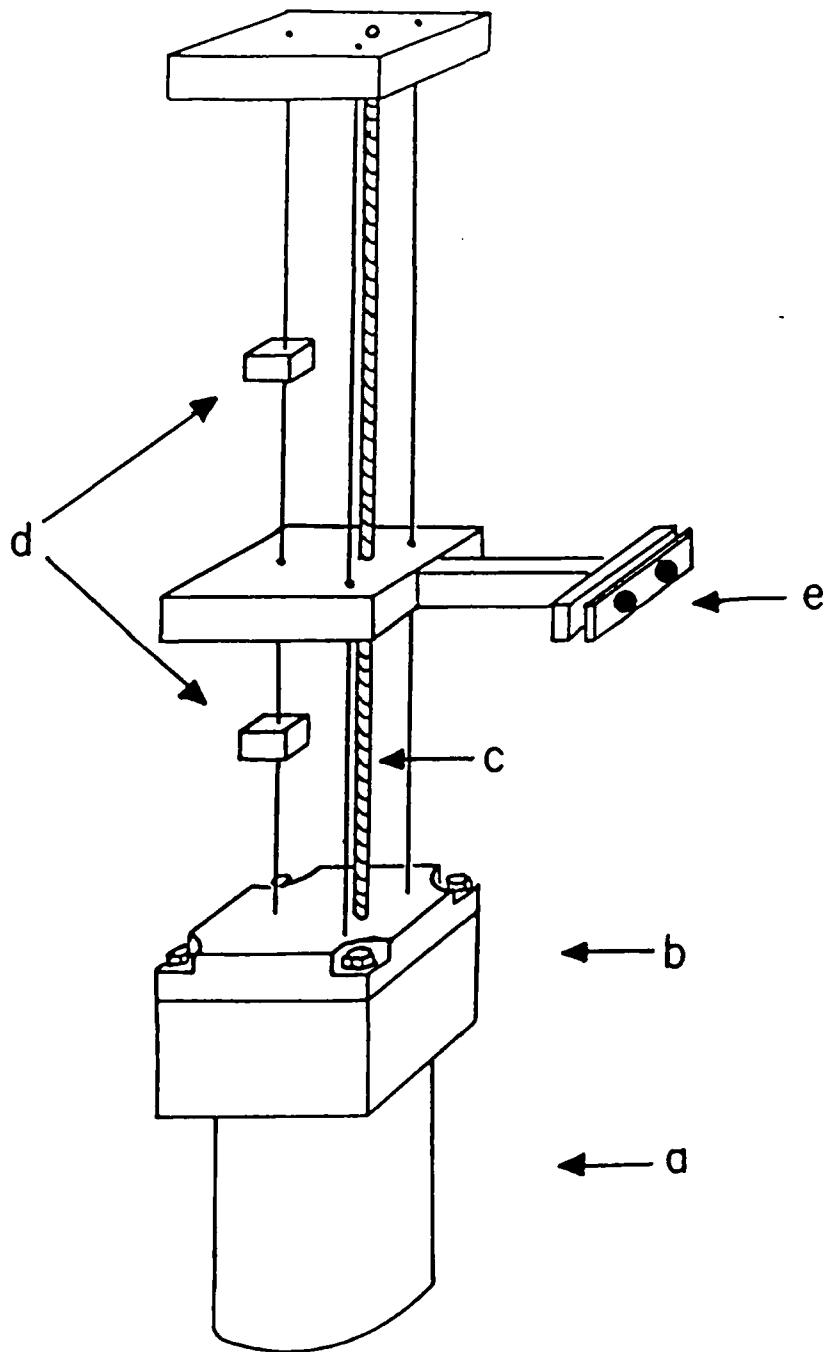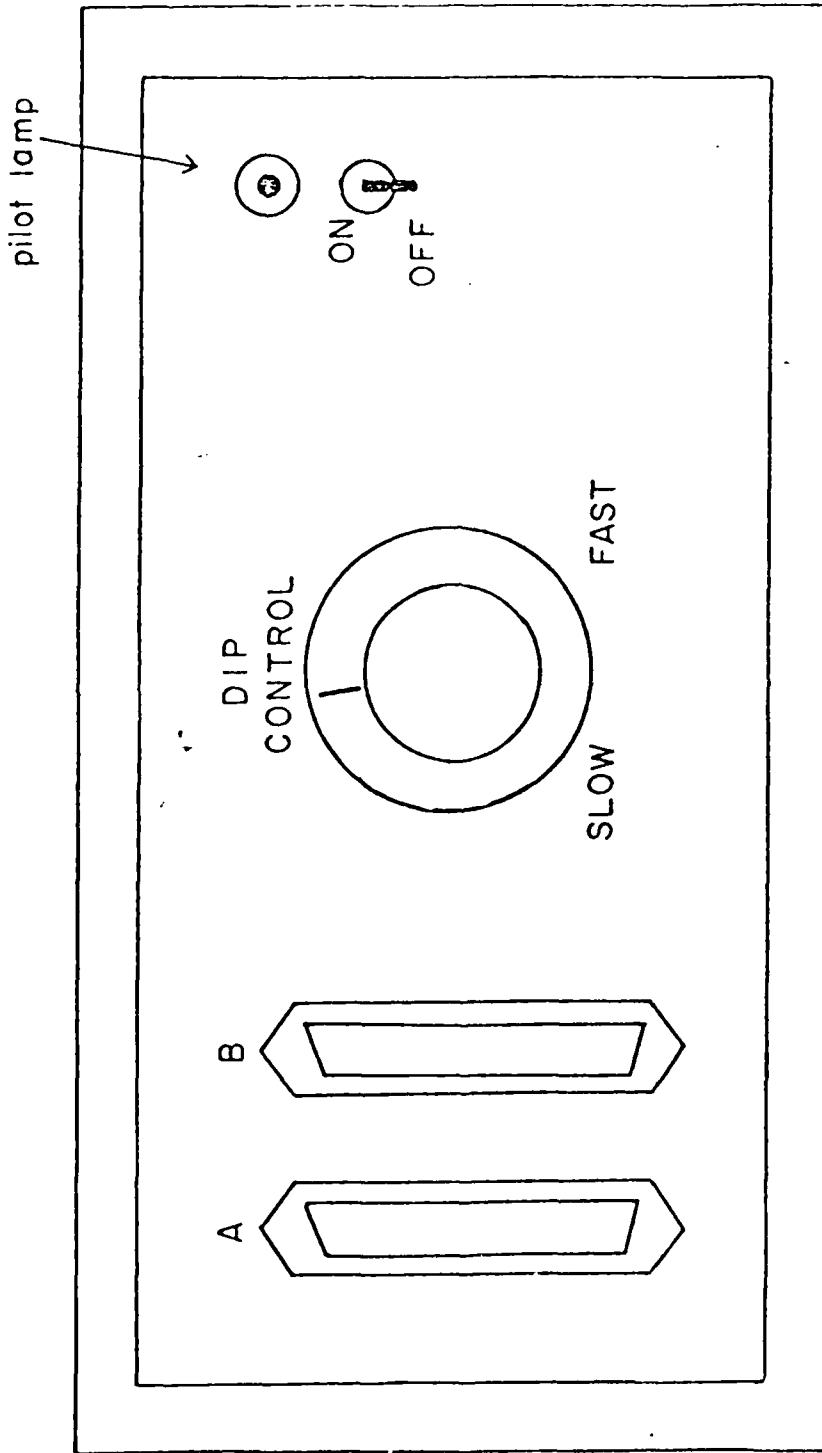
A & B = 36-pin Centronics, female chassis mount
DIP CONTROL = 1 kΩ variable resistor

BACK OF BOX

female 6-pin
Jones plug

25-pin D subminiature

36-pin D subminiature

fuse
1.25 amp

to 110V AC
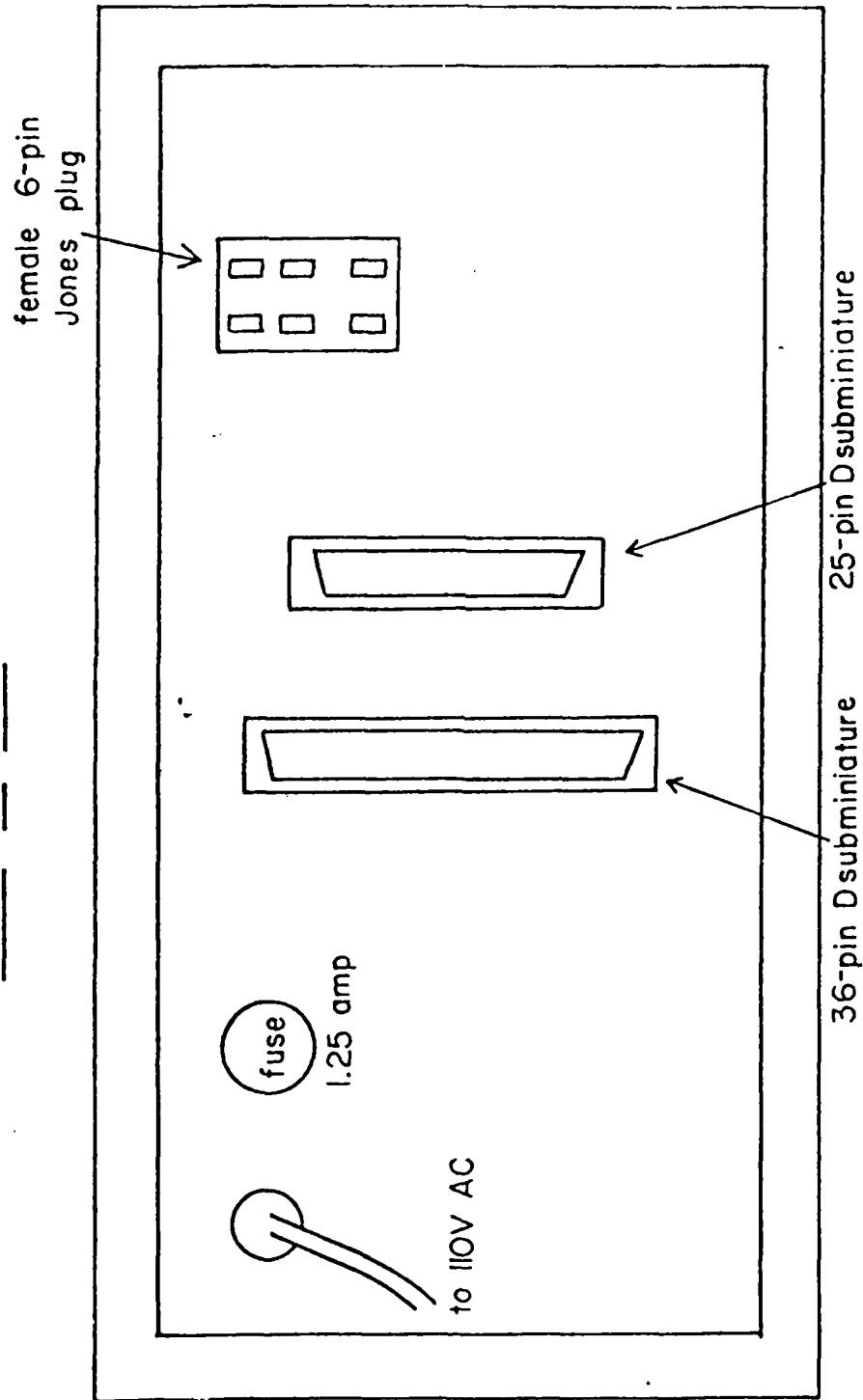
CONNECTION SCHEME *

J	B	37-D	
J1 1	19	5	
2	20	6	1st digit
3	21	7	
4	22	8	
5	23	9	
6	24	10	2nd digit
7	25	11	
8	26	12	
9	8		
10	7		
11	6	28	GND
12	5	29	Decimal wiper
13	4		
14	3		
15	2		
16	1		
J2 1	27	13	
2	28	14	3rd digit
3	29	15	
4	30	16	
5	31	17	
6	32	18	4th digit
7	33	19	
8	34	20	
9	16		
10	15		
11	14	28	GND
12	13		
13	12		
14	11		
15	10		
16	9		

* J= John Bell Engineering, Inc., 32-line digital I/O
interface card for Apple II computer

B= 36-pin Centronics connector, designated as B
on the front of the box

37-D= 37-D subminiature pin

CONNECTION SCHEME (cont.) *

J	A	37-D or 16 DIP	
J3 1	19	21	
2	20	4	1.xxxx
3	21	3	1x.xxx
4	22	2	1xx.xx
5	23	1	1xxx.x
6	24		
7	25		
8	26		
9	8		
10	7		
11	6		
12	5		
13	4		
14	3		
15	2		
16	1		
J4 1	27	6	dip dir. 1=down 0=up
2	28	7	dip 1=off 0=on
3	29	8	arm dir. 1=in 2=out
4	30	9	pulse
5	31		
6	32		
7	33		
8	34		
9	16		
10	15	GND	
11	14	GND	
12	13		
13	12		
14	11		
15	10		
16	9		

37-D

16 DIP

*J= John Bell Engineering Inc., 32-line digital I/O
   interface card for Apple II computer

A= 36-pin Centronics connector, designated as A on
   the front of the box

37-D = 37-D subminiature pin

16 DIP= 16 pin dual in-line package

14

INSIDE OF BOX

BACK

FRONT

JAMECO
#JE 210
POWER
SUPPLY

16 DIP

RELAY

RELAY

14 PIN

14 PIN

16   9

8   1

20

HURST
#22001
STEP. MOT.
CONTROL

11

10

1
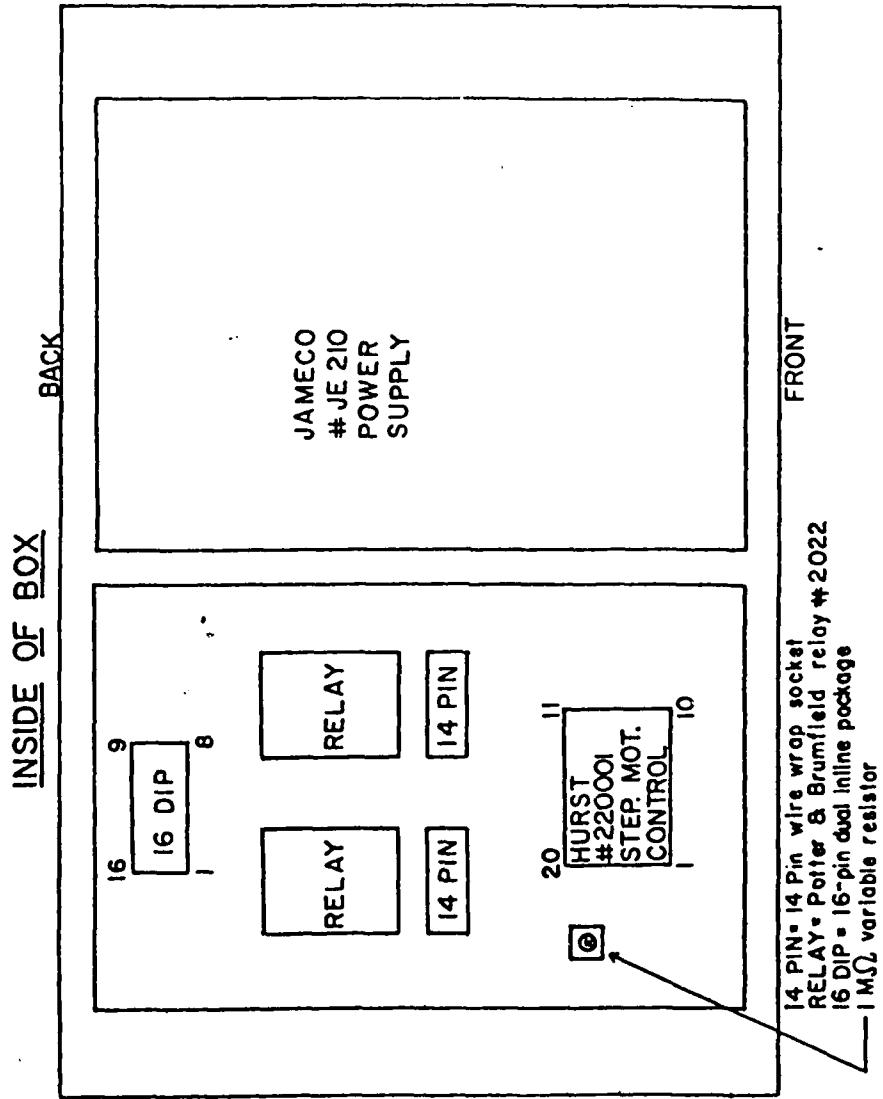
14 PIN= 14 Pin wire wrap socket
RELAY= Potter & Brumfield relay #2022
16 DIP = 16-pin dual inline package
1 MΩ variable resistor

CONTROL BOX

$V_c = +16 V$

SUB 25-connected to dipping arm motor
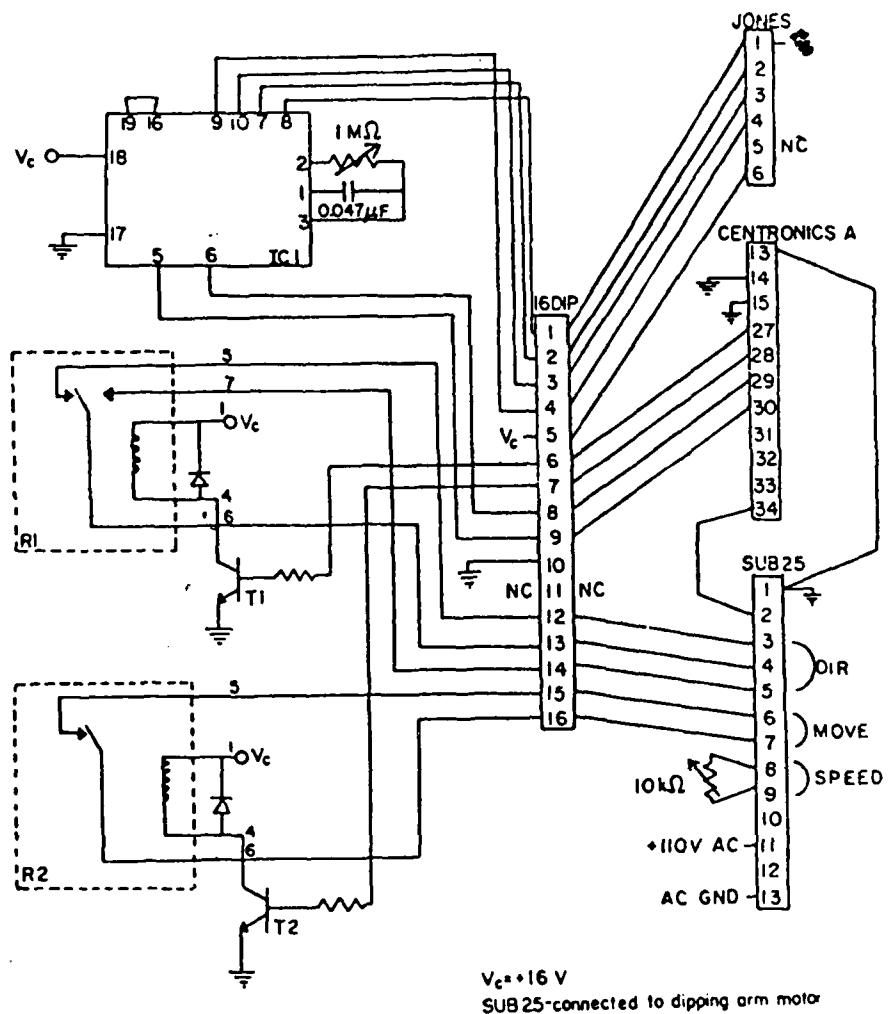
Note: R1-2 & T1-2 may be replaced by isolated, TTL compatible solid-state relays.

```
SCR#   0
\ LANGMUIR-BLODGETT DIPPING ROUTINES
\ H. VAN RYSWYK, 31 MAY 85
\ Revised 2 APR 86

\ c/o Prof. A.B. Ellis
\ Department of Chemistry
\ University of Wisconsin-Madison
\ 1101 University Avenue
\ Madison, WI 53706

\ This program coded in
\ Micromotion Masterforth V0.0
\ 12077 Wilshire Blvd, #506
\ Los Angeles, CA 90025
\ (213) 821-4340
```

```
SCR#   1
 0 \ BRINGING THE SYSTEM UP...
 1 \ BOOT DISK MUST ALREADY HAVE HIRES & FLOATING POINT ROUTINES
 2 \ IN PLACE--YOU MAY FORGET XTWO & COSTBL TO SAVE MEMORY SPACE
 3
 4   FORTH-83
 5   GRAPHICS ALSO
 6   2 18 THRU
 7
 8
 9
10
11
12
13
14
15
```

```
SCR#   2
\ CONSTANTS, VARIABLES, STRINGS, BUFFERS, AND TABLES
 50432 CONSTANT SWITCH     49152 CONSTANT KEYBOARD
 49168 CONSTANT STROBE     40    CONSTANT BUFSIZE
 454E0 FCONSTANT MFCONST  101.6E0 FCONSTANT AFNORM
 FVARIABLE PCVRT          FVARIABLE CPLATE
 FVARIABLE TARGET         FVARIABLE WTCLEAN
 2VARIABLE NUM1           2VARIABLE NUM2
 2VARIABLE P0             2VARIABLE POSIT
 2VARIABLE INC            VARIABLE FALLOFF
 VARIABLE WAIT-TIME       VARIABLE TREND
 CREATE BUF BUFSIZE ALLOT    CREATE BUF2 BUFSIZE ALLOT
 CREATE EL 2 ALLOT 13 EL C! : ENDLINE EL 1 ;

\ TABLES
 CREATE  DIGITS ( I/O PORT TABLE FOR JOHN BELL CARD )
 50433 , 50560 , 50561 ,
```

```
SCR#   3
 0 \ I/O
 1 : READSCALE ( READS CAHN,  --- FP )
 2  DIGITS @ C@ 1 AND ( READ MS-BIT )
 3  3 1 DO
 4     100 * I 2* DIGITS + @ C@ DUP 240 AND 16 / 10 * SWAP
 5     >R + R> 15 AND +
 6     LOOP ( INT CAHN READINGS ON STK )
 7  S>D FLOAT DIGITS @ C@ 30 AND ( FIND DECIMAL PLACE )
 8  DUP 14 = IF DROP 10
 9          ELSE DUP 22 = IF DROP 100
10          ELSE 26 = IF 1000
11          ELSE 10000
12          THEN THEN THEN S>D FLOAT F/ ;
13
14 : FINISHED ( FLAG FOR DIP ARM LIMIT EXCEEDED, --- F)
15   SWITCH C@ 128 AND IF -1 ELSE 0 THEN ;
```

```
SCR#   4
\ I/O
: HALT    ( HALTS T- AND DIP ARM )
  255 SWITCH C! ;

: UP      ( MOVE DIP ARM UP )
  HALT 252 SWITCH C! ;

: DOWN    ( MOVE DIP ARM DOWN )
  HALT 253 SWITCH C! ;

: PULSE   ( JOGS T-ARM ONE PULSE )
  SWITCH DUP C@ 8 XOR SWAP OVER OVER C! SWAP 8 XOR SWAP
  3 0 DO LOOP ( WAIT ) C! ;

: FLOP SWITCH DUP C@ 4 XOR SWAP C! ( FLIPS DIP DIR. ) ;
```

```
SCR#   5
 0 \ CONVERSION
 1 : VECTOR ( FP MG --- DN PULSES ) FABS PCVRT F@ F* FIX ;
 2
 3 : DMM     ( DN MM --- DN PULSES ) FLOAT MFCONST F* INT ;
 4
 5 : DYNETOMG ( CONVERTS PRESSURE IN DYNE/CM TO WEIGHT IN MG'S )
 6  ( FP --- FP ) CPLATE F@ F/ FNEGATE WTCLEAN F@ F+ ;
 7
 8 : MGTODYNE ( CONVERTS WEIGHT IN MG'S TO PRESSURE IN DYNES/CM )
 9  ( FP --- FP ) FNEGATE WTCLEAN F@ F+ CPLATE F@ F* ;
10
11 : READLN CR BUF BUFSIZE EXPECT BUF BUF2 SPAN @ CPACK ;
12
13 : GETFP ( --- FP ) READLN BUF2 DUP DUP C@ 1+ OVER C! DUP
14  C@ + 32 SWAP C! ( ADD SPACE ) FNUMBER FDUP DO= SWAP 0= AND
15  ABORT" USE SCIENTIFIC NOTATION " ;
```

```
SCR#    6
\ CONVERSION & I/O MACROS
: MM  S>D DMM    ( INTEGER MM TO DN PULSES ) ;

: AREA-OUT ( DN PULSES --- FP MM^2 )
  FLOAT AFNORM F* MFCONST F/ ;

: WAIT ( TIMING LOOP ) 8000 0 DO LOOP ;

: GETDN READLN BUF2 COUNT VAL DROP ( -- DN ) ;

: POSITION  ( SETS ARM POSITON VARIABLE )
  CR ." ARM POSITION (IN INTEGER MM'S) " GETDN
  DMM POSIT 2! CR ;

: SHOWSCALE ( DISPLAY CURRENT CAHN READING )
  READSCALE 4 9 F.R ;

SCR#    8
\ T-ARM & DIPPING ARM MACROS
\ T-ARM MOVEMENT ( FP --- DN )
: EQUALIZE ( EQ'S TO FP, LEAVES DN PULSES TRAVELED )
  READSCALE F- FDUP D0= SWAP 0= AND IF FDROP 0 S>D
  ELSE FDUP F0< IF VECTOR 2DUP COMPRESS DNEGATE
      ELSE VECTOR 2DUP EXPAND THEN
  THEN ;

: DIP
  BEGIN TARGET F@ EQUALIZE DABS 20. D< WAIT UNTIL 0 S>D
  DOWN BEGIN FINISHED NOT UNTIL DOWN
  BEGIN TARGET F@ EQUALIZE D+ WAIT FINISHED UNTIL
  HALT ." DELTA AREA = " AREA-OUT
  3 6 F.R ." MM^2" ;
```

```
SCR#    7
 0 \ T-ARM MOVEMENT ( DN --- )
 1 : EXPAND ( MOVE T-ARM OUT DN PULSES )
 2   2DUP POSIT 2@ D+ 2DUP NUM2 2@
 3   D< IF POSIT 2!
 4     ELSE 2DROP 2DROP
 5     ." RANGE EXCEEDED. " ABORT THEN
 6   BEGIN 2DUP D0= NOT WHILE FINISHED IF HALT THEN
 7   PULSE 1 S>D D- REPEAT 2DROP ;
 8
 9 : COMPRESS ( MOVE T-ARM IN DN PULSES )
10   FLOP ( SELECT DIRECTION )
11   2DUP POSIT 2@ 2SWAP D- NUM1 2@ D- 0< SWAP DROP IF 2DROP
12   ." RANGE EXCEEDED." ABORT ELSE 2DUP POSIT 2@ 2SWAP D- POSIT 2
13   THEN BEGIN 2DUP D0= NOT WHILE FINISHED IF HALT FLOP THEN
14   PULSE 1 S>D D- REPEAT
15   FLOP 2DROP ;

SCR#    9
 0
 1 : UNDIP
 2   BEGIN TARGET F@ EQUALIZE DABS 20. D< WAIT UNTIL 0 S>D
 3   UP BEGIN FINISHED NOT UNTIL UP
 4   BEGIN TARGET F@
 5   EQUALIZE D+ WAIT
 6   FINISHED UNTIL
 7   HALT ." DELTA AREA = " AREA-OUT
 8   3 6 F.R ." MM^2" ;
 9
10
11
12
13
14
15
```

```
SCR#   10
: CLEANWATER ( SETS CLEAN WATER WEIGHT VARIABLE )
  CR ." WEIGHT FROM CLEAN SURFACE ( IN MG'S SCI NOT)? "
  GETFP WTCLEAN F! CR ;

: DEPOSIT
  CR ." DESIRED SURFACE PRESSURE IN SCI. NOT. (DYNES/CM)? "
  GETFP DYNETOMG TARGET F! CR
  ." NUMBER OF COMPLETE CYCLES (INTEGER)? " GETDN DROP
  1+ HOME 1 DO I . ." DIP DOWN, " DIP WAIT UP WAIT
  BEGIN FINISHED NOT UNTIL HALT CR ."         UP, "
  UNDIP WAIT DOWN WAIT BEGIN
  FINISHED NOT UNTIL HALT CR
  LOOP 3 0 DO 7 EMIT LOOP ." DONE!" CR ;
```

```
SCR#   11
 0 \ DATA TRANSFERAL PRIMITIVES
 1 : ARRAY ( # OF CELLS, CELL BYTES --- ) ( N --- ^ELEMENT )
 2   CREATE DUP , * ALLOT
 3   DOES> DUP @ ROT * + 2+ ; 150 6 ARRAY PRESSURE
 4
 5 \ GRAPHICS
 6 : PLOT-INIT HGR 0 2000 10000 10000 VIEWPORT-SET
 7   HOME 0 20 AT 0 0 14000 750 WINDOW-SET
 8   0 750 MOVETO 0 0 LINETO 14000 0 LINETO
 9   8 0 DO I 100 * DUP 0 SWAP MOVETO
10     DUP 468 SWAP LINETO 50 + DUP 0 SWAP MOVETO
11     234 SWAP LINETO LOOP ;
12
13 : PLOT-IT ( PLOTS P[N] VS. POSIT, N --- )
14   POSIT 2@ AREA-OUT FIX 6200. D- DROP
15   SWAP PRESSURE F@ 1E1 F* FIX DROP PLOT ;
```

```
SCR#  12                                              SCR#  13
\ PRIMATIVES                                          0 \ DATA STORAGE
: KEYCHECK KEYBOARD C@ 128 ) DUP IF 0 STROBE C! THEN ( -- F ) ;   1 : STORE? ( QUERRY, --- F ) CR ." DO YOU WANT TO SAVE THIS RUN?"
                                                      2   READLN BUF2 1+ C@ DUP ASCII Y = )R ASCII y = R) OR ;
: (PA) 9 S)D BEGIN 1. D+ 2OVER COMPRESS              3
  WAIT-TIME @ 0 DO WAIT LOOP READSCALE MGTODYNE      4 : STOREDATA ( DN --- , WHERE N IS THE T-ARM INCREMENT )
  FDUP 7 PICK DUP )R PRESSURE F! R) PLOT-IT          5   CR ." FILE NAME? " READLN 2 DR# BUF2 COUNT TEXT MAKE IS OUTPL
  4 PICK 1- PRESSURE F@ F<                           6   ." DATA TRANSFER IN PROGRESS..." CR
  IF FALLOFF DUP @ 1+ SWAP ! ELSE 0 FALLOFF ! THEN   7   0 PRESSURE F@ 2E0 F* WRITEOUT
  POSIT 2@ NUM1 2@ 2OVER 2OVER D< )R D= R) OR        8   PO 2@ 0 PRESSURE F@ FIX DROP
  FALLOFF @ TREND @ = OR KEYCHECK OR UNTIL ;         9   1+ 1 DO
                                                      10     2DUP AREA-OUT WRITEOUT
: WRITEOUT ( FP --- )                                 11     2OVER D+
  5 (E.R) PUTFILE ENDLINE PUTFILE ;                   12     I PRESSURE F@ WRITEOUT
                                                      13     LOOP OUTPUT CLOSE 2DROP 2DROP ;
                                                      14
                                                      15


SCR#  14                                              SCR#  15
\ RECORD PRESSURE-AREA CURVES                         0 \ PA'S, CONT.
: PA        ( --- N , WHERE N IS THE T-ARM INCREMENT )   1 : PA-REVERSE ( REVERSES PA CURVE, --- ) POSIT 2@ PO 2!
  HOME ." P-A CURVES..." CR CR                        2   HOME 0 20 AT GR ." P-A REVERSE..."
  ." INCREMENT (INT MM'S)? " GETDN DMM 2DUP INC 2!    3   0 PRESSURE F@ FIX DROP 1+ 1 DO
  PLOT-INIT POSIT 2@ PO 2!                            4     INC 2@ EXPAND WAIT-TIME @ 0 DO WAIT LOOP
  10 0 DO 2DUP COMPRESS WAIT-TIME @ 0 DO WAIT LOOP    5     READSCALE MGTODYNE I PRESSURE F! I PLOT-IT
        ( LET SCALE SETTLE ) READSCALE MGTODYNE       6   LOOP
        I PRESSURE F! I PLOT-IT LOOP                  7   STORE? IF INC 2@ STOREDATA THEN TX ;
        ." PRESS ANY KEY TO STOP." CR                 8
        0 FALLOFF ! (PA) FLOAT 0 PRESSURE F! CR       9
       STORE? IF DNEGATE STOREDATA ELSE 2DROP THEN TX ;   10
                                                      11
                                                      12
                                                      13
                                                      14
                                                      15


SCR#  16                                              SCR#  17
\ MACRO MOVES                                         0 \ SYSTEM REPORTS
: WHERE? ( REPORTS TENSION ARM POSITION )            1 : STATUS HOME
  POSIT 2@ FLOAT MFCONST F/ 1 4 F.R ." MM." ;        2   ." TRANSVERSE ARM IS AT          " WHERE? CR
                                                      3   ." WEIGHT FROM CLEAN SURFACE IS " WTCLEAN F@ F. ." MG." CR
: TOP     ( MOVE DIP ARM TO TOP OF RANGE, THEN OFFSET )   4   ." TREND IS                      " TREND @ . ." POINTS." CR
  FINISHED NOT IF UP BEGIN FINISHED UNTIL HALT WAIT  5   ." WAIT-TIME IS                  " WAIT-TIME @ . ." SEC." CR
  DOWN BEGIN FINISHED NOT UNTIL HALT THEN ;          6   SWITCH C@ DUP 3 AND 0 = IF ." DIPPING ARM UP."
                                                      7   ELSE 2 AND 0 = IF ." DIPPING ARM DOWN."
: BOTTOM ( AS WITH TOP... )                          8   ELSE ." DIPPING ARM AT REST." THEN THEN CR CR ;
  FINISHED NOT IF DOWN BEGIN FINISHED UNTIL HALT WAIT  9
  UP BEGIN FINISHED NOT UNTIL HALT THEN ;            10
                                                      11
                                                      12
                                                      13
                                                      14
                                                      15
```

```
\ INITIALIZATION
: STARTUP 80COL
  127 SWITCH 2+ C!    255 SWITCH C!
  30418. NUM1 2!      89438. NUM2 2! ( ABSOLUTE PULSE #'S )
  10E0 PCVRT F!       0.491E0 CPLATE F!
  3 TREND !           6 WAIT-TIME !
  ." TURN BOX ON..." CR CR
  CLEANWATER
  POSITION ;
```

Dictionary of Terms

Position enters the correct the position of the arm into the computer.

Where? tells where the computer thinks the compression arm is. (Position is read from leading teflon edge of the arm, towards the dipping well.)

Cleanwater inputs changes in the surface pressure of the clean, film free, water surface.

Up moves the dipping arm up (Must be stopped with the **Halt** command) Use carefully!

Down moves arm down (Must be stopped with the **Halt** command) Use carefully!

Halt stops the motion of the dipping arm in the up or down mode.

Top moves the dipping arm to top of the range and then offsets.

Bottom moves the dipping arm to the bottom of the range and then offsets.

Status lists the status of the system.
```
          transverse arm      (in motion or at rest)
          wieght from clean surface          ###
          trend is                #
          wait-tim                #
          dipping arm         (in motion up/down or at rest)
```

X MM Compress (or) Expand will move the compression arm the desired mm's.

PA will measure the Fi-A curve. It will ask for intervals—1mm is best to get accurate results. Program stops after recording three consecutive points where the surface pressure decreased.

Pa-Reverse runs a backward Fi-A curve to examine the extent of collapse and hysterisis. Unfortunately, there is often transfer of film to the plate which prevents a real measurement of the surface pressure on the reverse.

Storedata stores the PA curve if the program should be unwiling to let you do so automatically.

Deposit will deposit films on the slide. It will ask for pressure of transfer and for the number of dipping cycles desired. It is best to have the surface pressure close to that desired for dipping to prevent the computer from over stepping the condensed phase. There are times when the deposit cycle believes it has made several dips when in realitiy it has only done one. This can be seen in the area changes listed for each dip. (An area change of 0 would indicate no dip was made.) Also, changes in the dipping arm contacts are possible to vary the time for the cycles. Greater separation of the contacts gives longer times to allow the film to dry, closer distances give shorter times so each dip accomplished faster.

Dip is a sub command of Deposit and brings the slide down while maintaining the constant surface pressure given in the deposit command.

Undip is a sub command of the deposit routine. It brings the slide up while maintaining the constant surface pressure given in the deposit command. This is particularly useful if the switch fails, as it often does on the slow first dip.

XEN MGTODYNE F. converts the scale measurement of mg to the surface pressure in dynes. The number must be in scientific notation $147=1.47E2=147E0$ either of the last two are acceptable.

XEN DYNETOMG F. converts the surface pressure in dynes to a force in mg readable from the scale. Again, this must be in scientific notation.

Variables that are variable!
In order to see these, type "status" which will repond with the present value for each of these (not Cplate):

Trend is the number of consecutive points which have decreasing surface pressures which the PA curve uses as the signal for collapse of the film. Not as important now that the PA can be stopped from the key-board after the first six points.

Wait-time is the time the computer waits between 1mm steps. This allows variation of the compression rate (approx. 3A2/molecule/minute).

Cplate is the inverse of the perimeter of the Wilhelmy plate, needed only with a new plate.

To Change a Variable: # VariableName !(CR)   integer
                          # VariableName F!(CR)   floating pt. number

END

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